

## FQT4N20L 200V LOGIC N-Channel MOSFET

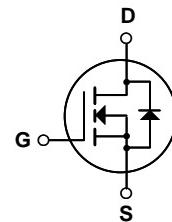
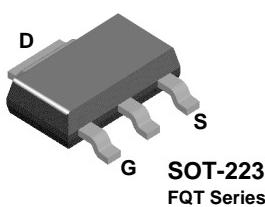
### General Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switching DC/DC converters, switch mode power supply, DC-AC converters for uninterrupted power supply, motor control.

### Features

- 0.85A, 200V,  $R_{DS(on)} = 1.35\Omega$  @  $V_{GS} = 10$  V
- Low gate charge ( typical 4.0 nC)
- Low  $C_{RSS}$  ( typical 6.0 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Low level gate drive requirement allowing direct operation from logic drivers



### Absolute Maximum Ratings

$T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	FQT4N20L	Units
$V_{DSS}$	Drain-Source Voltage	200	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	0.85	A
	- Continuous ( $T_C = 70^\circ\text{C}$ )	0.68	A
$I_{DM}$	Drain Current - Pulsed	(Note 1)	A
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	mJ
$I_{AR}$	Avalanche Current	(Note 1)	A
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	2.2	W
	- Derate above $25^\circ\text{C}$	0.018	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	57	$^\circ\text{C}/\text{W}$

\* When mounted on the minimum pad size recommended (PCB Mount)

## Electrical Characteristics

$T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$	200	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.16	--	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 200 \text{ V}$ , $V_{GS} = 0 \text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 160 \text{ V}$ , $T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 20 \text{ V}$ , $V_{DS} = 0 \text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -20 \text{ V}$ , $V_{DS} = 0 \text{ V}$	--	--	-100	nA

## On Characteristics

$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$	1.0	--	2.0	V
$R_{DS(\text{on})}$	Static Drain-Source On-Resistance	$V_{GS} = 10 \text{ V}$ , $I_D = 0.425 \text{ A}$ $V_{GS} = 5 \text{ V}$ , $I_D = 0.425 \text{ A}$	--	1.10 1.13	1.35 1.40	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 30 \text{ V}$ , $I_D = 0.425 \text{ A}$ (Note 4)	--	1.42	--	S

## Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}$ , $V_{GS} = 0 \text{ V}$ ,	--	240	310	pF
$C_{oss}$	Output Capacitance	$f = 1.0 \text{ MHz}$	--	36	45	pF
$C_{rss}$	Reverse Transfer Capacitance		--	6	8	pF

## Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 100 \text{ V}$ , $I_D = 3.8 \text{ A}$ , $R_G = 25 \Omega$	--	7	25	ns
$t_r$	Turn-On Rise Time		--	70	150	ns
$t_{d(off)}$	Turn-Off Delay Time		--	15	40	ns
$t_f$	Turn-Off Fall Time		--	40	90	ns
$Q_g$	Total Gate Charge	$V_{DS} = 160 \text{ V}$ , $I_D = 3.8 \text{ A}$ , $V_{GS} = 5 \text{ V}$	--	4.0	5.2	nC
$Q_{gs}$	Gate-Source Charge		--	1.0	--	nC
$Q_{gd}$	Gate-Drain Charge		--	1.9	--	nC

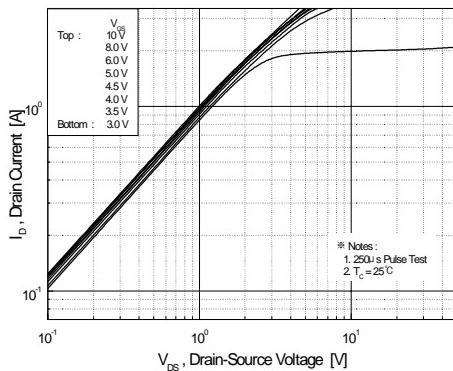
## Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	0.85	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	3.4	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}$ , $I_S = 0.85 \text{ A}$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{ V}$ , $I_S = 3.8 \text{ A}$ ,	--	90	--	ns
$Q_{rr}$	Reverse Recovery Charge	$dI_F / dt = 100 \text{ A}/\mu\text{s}$	(Note 4)	--	0.25	$\mu\text{C}$

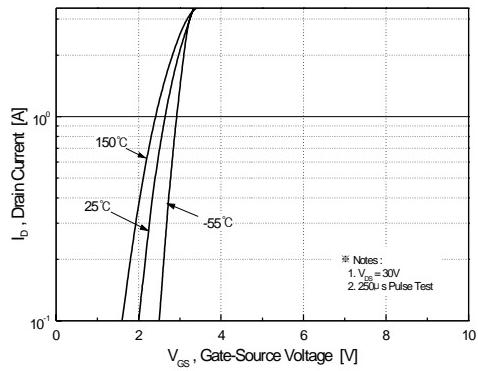
### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 108\text{mH}$ ,  $I_{AS} = 0.85\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25 \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 3.8\text{A}$ ,  $dI/dt \leq 300\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

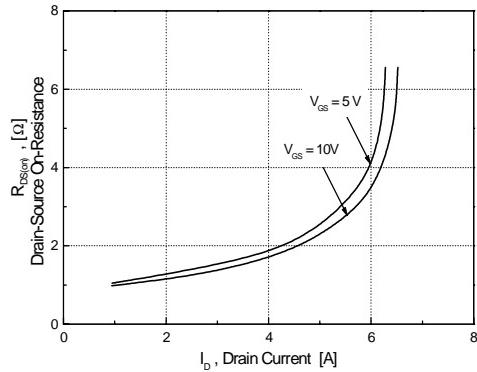
## Typical Characteristics



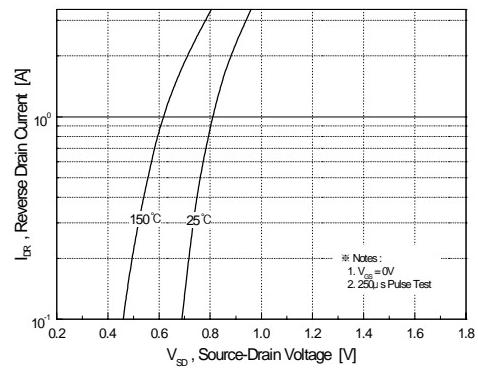
**Figure 1. On-Region Characteristics**



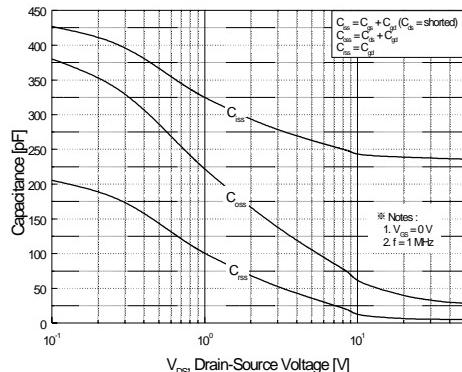
**Figure 2. Transfer Characteristics**



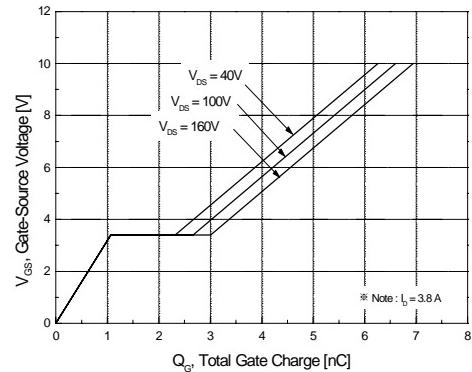
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

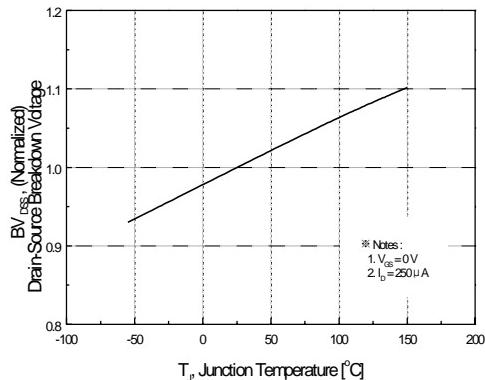


**Figure 5. Capacitance Characteristics**

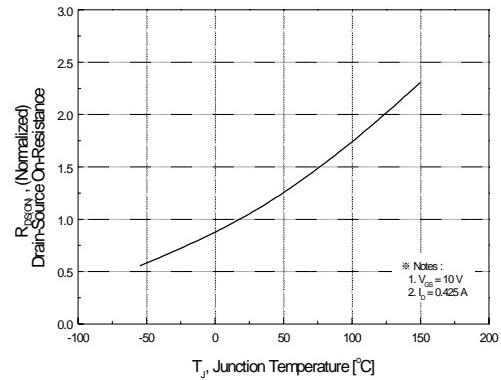


**Figure 6. Gate Charge Characteristics**

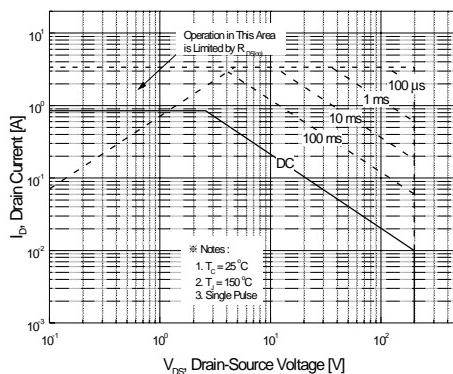
## Typical Characteristics (Continued)



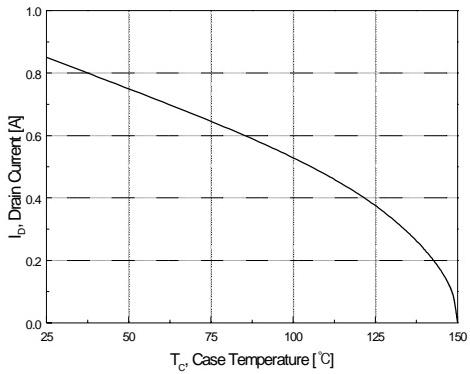
**Figure 7. Breakdown Voltage Variation vs. Temperature**



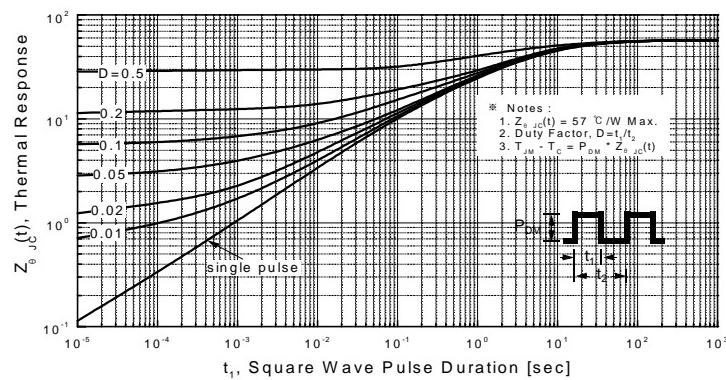
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**

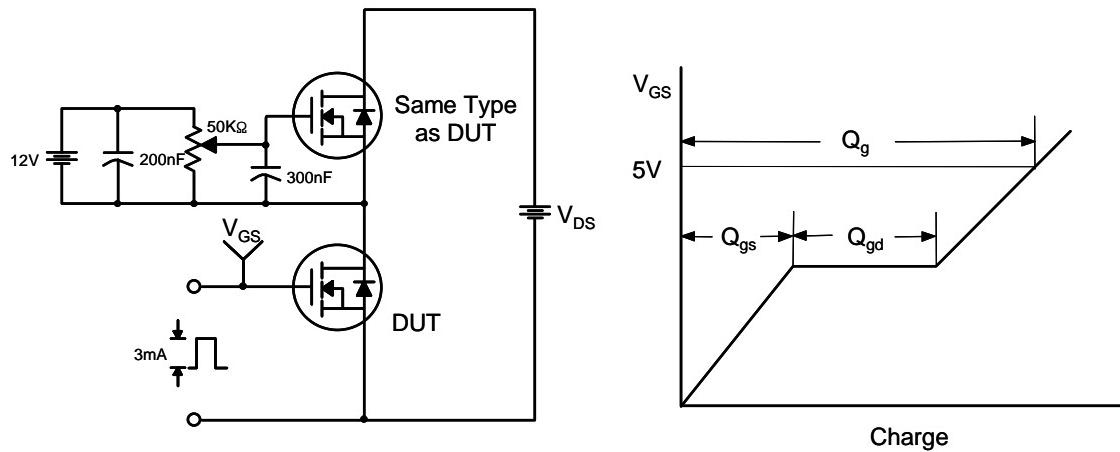


**Figure 10. Maximum Drain Current vs. Case Temperature**

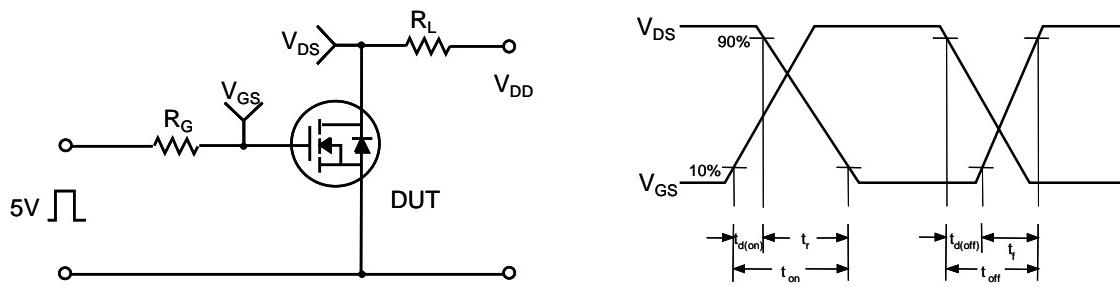


**Figure 11. Transient Thermal Response Curve**

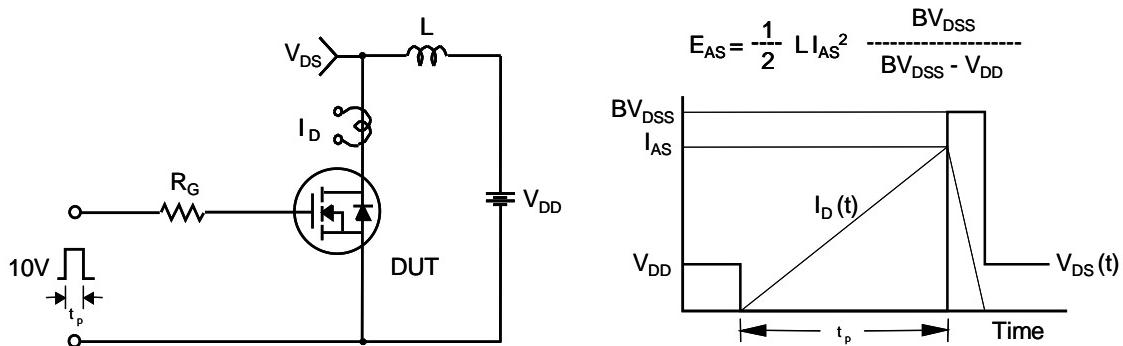
## Gate Charge Test Circuit &amp; Waveform



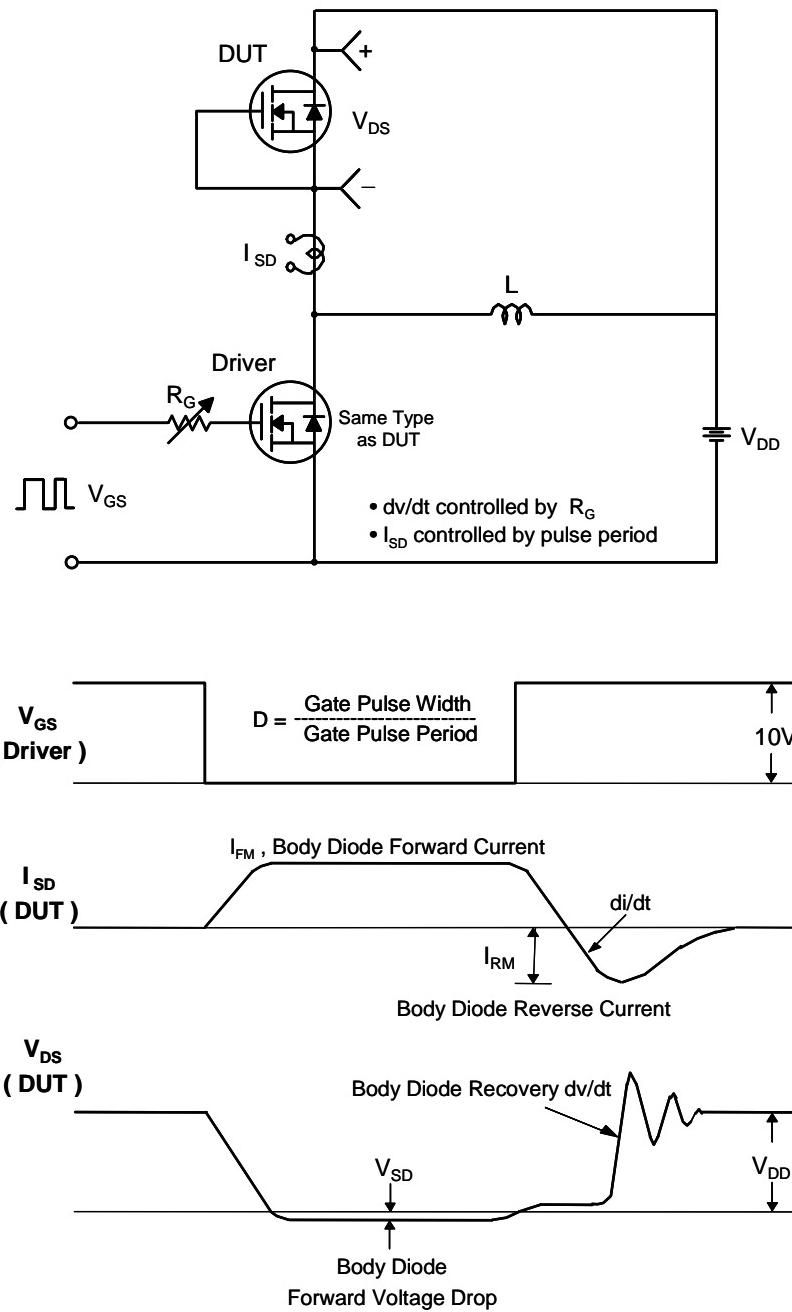
## Resistive Switching Test Circuit &amp; Waveforms



## Unclamped Inductive Switching Test Circuit &amp; Waveforms



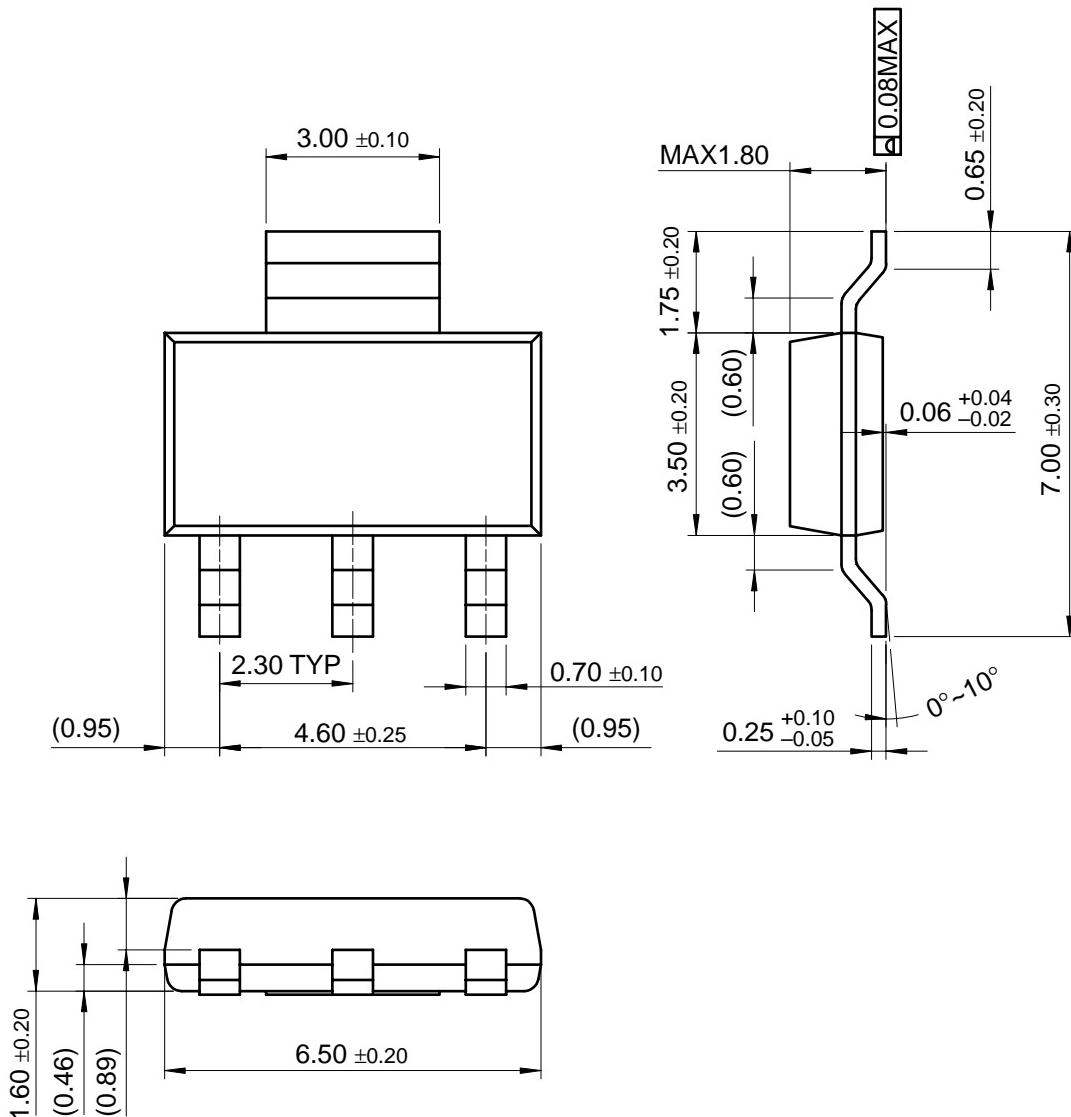
## Peak Diode Recovery dv/dt Test Circuit &amp; Waveforms



**FQTN20L**

**Package Dimensions**

**SOT-223**



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